EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	46	(("6,840,852") or ("6,648,751") or ("6,443,833") or ("6,135,880") or ("5,766,069") or ("5,660,588") or ("5,022,583") or ("4,217,816") or ("4,007,673") or ("3,699,873") or ("3,677,166") or ("3,242,846") or ("2,985,093") or ("2,800,851") or ("2,196,308")).PN.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2007/08/04 12:18
L2	15	("1725353" | "3063357" | "3330202" | "5176568" | "5299978" | "5354235").PN. OR ("5660588"). URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2007/08/04 12:20
L3	215	("454".clas. or "62".clas. or "236. clas") and (direct$3 same air same away same (person or occupant or human)) and (air adj condition$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 12:48
L5	6	("454".clas. or "62".clas. or "236. clas") and (powerful with operation) and (person or occupant or human) and (air adj condition$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 12:51
L6	14	("2264495" | "2933151" | "3750556" | "3936698" | "4951172" | "5055115" | "5428964" | "5433772" | "5527459" | "5728288" | "6432367" | "6668563").PN. OR ("7040101").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2007/08/04 12:50
L7	9	("454".clas. or "62".clas. or "236. clas") and (powerful with operation) and sensor and (air adj condition$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 12:54
L8	314	("454".clas. or "62".clas. or "236. clas") and ((occupan$4 or human or infrared or motion) near (detect$3 or sens$3)) and (air adj condition$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 12:56
L9	3	("5145112" | "6196468" | "6397615").PN. OR ("7185504"). URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2007/08/04 13:04

EAST Search History

L11	18811	Samsung$.as. and Choi$.in.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 13:49
L12	276	L11 and (air adj condition$3)	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 13:49
L13	150	L12 and @pd<="20030927"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 16:50
L14	0	L13 and ((occupan$4 or human or infrared or motion) near (detect$3 or sens$3))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 16:17
L15	502	454/284.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 15:01
L16	160	454/285.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 15:06
L17	86	454/320.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 15:52
L18	191	454/259.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 15:18

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L19	418	454/256.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 15:29
L20	276	454/319.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 15:22
L21	350	454/309.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 15:58
L22	159	454/315.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 16:16
L23	1756	62/186.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 16:28
L24	39	L23 and ((occupan$4 or human or infrared or motion) near (detect$3 or sens$3))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 16:28
L25	1354	236/49.3.ccls.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 16:28
L26	123	L25 and ((occupan$4 or human or infrared or motion) near (detect$3 or sens$3))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 16:41

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L28	87	(L15 or L16 or L17 or L18 or L19 or L20 or L21 or L22 or L23) and ((occupan$4 or human or infrared or motion) near (detect$3 or sens$3))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 16:49
L29	50	(US-20060286923-$ or US-20040079094-$ or US-20040050077-$ or US-20030205052-$).did. or (US-5660588-$ or US-6318113-$ or US-5546754-$ or US-7185504-$ or US-5637040-$ or US-5634846-$ or US-5634346-$ or US-5586935-$ or US-5478276-$ or US-5331825-$ or US-5180333-$ or US-5097672-$ or US-5833531-$ or US-5775989-$ or US-5456633-$ or US-5971846-$ or US-5769707-$ or US-5242325-$ or US-5924923-$ or US-5372545-$ or US-5797792-$ or US-5251814-$ or US-5875639-$ or US-5857906-$ or US-5815078-$ or US-5326028-$). did. or (US-5839953-$ or US-5833532-$).did. or (GB-2260830-$).did. or (JP-02259357-$ or JP-01281360-$ or JP-01079534-$ or JP-01079533-$ or JP-01079532-$ or JP-61122449-$ or JP-61122443-$ or JP-09119694-$ or JP-07019573-$ or JP-04028952-$ or JP-58088546-$ or JP-05066049-$ or JP-63113248-$ or JP-06207737-$ or JP-01147244-$ or JP-60221649-$).did. or (KR-99020737-$).did.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2007/08/04 16:49
L30	32	L29 and ((occupan$4 or human or infrared or motion) near (detect$3 or sens$3))	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 16:49
L31	27	L30 and @pd<="20030927"	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 16:50

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L32	394	Oka-Seiji$.in.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 17:40
L33	1182	Suzuki-Toru$.in.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 17:43
L34	55	L33 and (Daikin$).as.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 17:41
L36	35	Nakai-Akinori$.in.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 17:48
L37	1	Nagamine-Mituaki$.in.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 17:49
L38	18	Nagamine-Mitsuaki$.in.	US-PGPUB; USPAT; USOCR; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2007/08/04 17:49
L39	7	("4147095" | "4729293" | "5039008" | "5097672").PN. OR ("5180333").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2007/08/04 18:06

VENTILATION DEVICE ADJUSTED AND CONTROLLED AUTOMATICALLY WITH MOVEMENT OF HUMAN BODY

This invention relates to a ventilation device which can automatically turn on. turn off. adjust the discharging time. direction and conditions of air while detecting the presence. position of human bodies in the area to be ventilated.

The indoor ventilation devices of conventional air conditioners or the ventilation devices of general purpose electric fans usually use a set of control blades which can be manipulated manually or automatically to adjust the discharging direction of air. The direction in which air is discharged. however. can not be modulated to follow along the movement of human body. In other words. the direction either is fixed or keeps moving to and fro within a certain area. This may cause unnecessary power consumption when no person is in the area to be ventilated. or only those in the area can enjoy the air flow. When the power of an air conditioner or a cooler/heater is turned on. the indoor temperature in the area to be ventilated can not be uniformly warmed up or cooled down immediately. and people who stay in the area may feel sudden cool or sudden warm as they walk around. It takes time and consumes energy to achieve uniform temperature in the entire area. Furthermore. people may have their preferred temperatures and discharging conditions -- that is. the fixed temperature and discharging intensity can not meet their respective preferences. Economically. to save energy. it is not necessary to cool/warm the whole room. In fact. as long as the ventilation device

follows the movements of human bodies and discharges air relating to people's preferred intensities, temperatures and (relative) humidities of discharged air, the ventilation requirements are met. Even when there are several persons in the ventilating area, the ventilation device can direct discharged air toward them respectively, instead of purposelessly discharging air with the same speed through the whole area. Additionally, the power of the ventilation device automatically will turn on as people enter the ventilating area and turn off as they leave the ventilating area. The intensity of the discharging air that follows the movement of the human body varies with the person's preference and the distance from the air source to the person. Thus the speed of airflow that reaches the position of the person is just what is required. According to the present invention the above mentioned operations are all automatic and fulfils the energy saving policy.

Moreover, the ventilation outlets of the conventional air conditioners are usually left open. When the air conditioner is not in use, the outlets collect dust and insects; and as the air conditioner is turned on the next time, the impurities will be blown out into the ventilated area and the user feels uncomfortable. Furthermore, if the impurities get into the heat exchanger, they will cause a negative effect on the efficiency of the heat exchanger. Thereby, it is necessary to close all the ventilation outlets while not in use to keep the air conditioner clean and efficient.

To solve these mentioned problems, the present invention mainly provides a ventilation device which can automatically turn on, turn off, and modulate the direction of discharged air according to the presence

and position of the human bodies in the area to be ventilated.

The second object of this invention is to provide a ventilation device which can modulate the direction and intensity of discharged air based on the individual preference of the user and based upon the distance between the user to the device.

The third object of this invention is to provide a ventilation device which enables the discharging conditions (fixed or varying intensity, temperature, and humidity of the discharged air, direct or indirect blowing, etc.) and duration of discharged air to be modulated based on the user's respective requirement.

The fourth object of this invention enables the ventilation device, while power is off, to close all the ventilation outlets to avoid dust entering the device.

The fifth object of the present invention is to provide a ventilating device having a human sensor positioned at a horizontal-movable grilles and can integrally follow the swing to detect and measure the presence and position of human body.

The sixth object of the present invention is to provide a ventilating device able to discharge air directly toward the physical position of human body or discharge air around a person and avoid direct air discharging toward human body.

To achieve the above mentioned objects, the ventilation device of this invention includes an air source, a user input unit, a sensor unit and a group of control units to control the operation of the air source, to vary the speed of the air source, and to control the discharging conditions and

the direction of discharged air according to user's requirement. The sensor unit detects/measures the presence. number and position of human bodies in the ventilating area. and then operates the control units to turn on the air source and related control units when the first person gets in the ventilating area and to turn them off while the last person leaves the area. When the control units are on, the discharging direction and intensity are modulated based on the location of the user. The sensor units further trace or follow the human bodies which enable the control units to provide the required ventilation. When the ventilation device stops operating, the outlets are closed as well to avoid dust and impurities. The sensor units can be positioned at a horizontal-movable grilles to integrally scan and detect with the grilles the position of human body.

This invention will be best understood from the following descriptions of specific embodiments when read in connection with the accompanying drawings.

FIG. 1 is a diagram illustrating the basic structure of this invention.

FIG. 2 is an embodiment of an electrical circuit structure illustrating a sensor unit and a controller of this invention.

FIG. 3 is a diagram illustrating the structure and function of a first embodiment of this invention.

FIG. 4 is a diagram illustrating a variation of the first embodiment of this invention; wherein, the air source and the control device can blow air with respective temperatures.

FIG. 5 is a sectional view in the position 5-5 of FIG. 4.

FIG. 6 is a diagram illustrating another variation of the first embodiment of this invention; wherein, the control device controls the quantity and direction of discharged air.

FIG. 7 is a diagram illustrating further variation of the first embodiment; wherein, the control device controls the discharging direction of discharged air.

FIG. 8 is a sectional view in the position of 8-8 of FIG. 7.

FIG. 9 is a diagram illustrating the structure and function of embodiment of FIG. 9 of this invention.

FIG. 10 is a diagram illustrating further variation of the control device of the embodiment of FIG. 9 of this invention.

FIG. 11 is a diagram illustrating a sensor unit of an embodiment of this invention.

FIG. 12 is a diagram illustrating the function of the sensor unit of the embodiment of FIG. 10 which distinguishes the position of the human body.

FIG. 13 is a diagram illustrating the outward appearance of another embodiment having a human sensor positions at horizontal movable grilles.

FIG. 14 is a diagram illustrating the function of sensor unit of the embodiment of FIG. 13.

FIG. 15 is a diagram illustrating the ventilating function of regulating the discharging air toward the human body of embodiment of FIG. 13.

FIG. 16 is a diagram illustrating the ventilating function of embodiment of FIG. 13 for regulating the discharging air around the physical position of human body and avoiding direct air discharging.

As FIG. 1 shows, a ventilation device T of this invention mainly comprises of an air source 1, a sensor unit 3, and a control device 2 to control the ON/OFF of the air source and to vary the speed of the air source 1 and to modulate the condition and direction of discharged air. The sensor unit 3 is to detect/measure if there are any users P1, P2 in the ventilating area R and their locations. If the sensor unit 3 senses a person in the area. sensor unit 3 sends message to a controller 20 (such as a microcomputer), which turns on the air source 1 and the control device 2. and modulates the direction and intensity of the discharged air based on the location of the users. As shown in the FIG. 1, air source blows gentle intensity airflow W1 to the user P1 who is close to the air source 1, and strong intensity airflow W2 to the user P2 who is far from the air source 1. When no person is sensed in the ventilating area, it enables the air source 1 and the control device 2 to be turned off. The sensor unit 3, furthermore, can follow a specific user and enable the control device 2 to provide specific airflow requested by the user. For example, when two users P1, P2 use the controller 20 to set respective requirements for cooler or warmer air, the air source 1 will generate the required air with fixed temperature and humidity, and the control device 2 will follow the users P1, P2 and provide stronger intensity airflow for a longer time, and gentle intensity airflow for a shorter time respectively. Alternatively, the air source 1 will separately provide the users P1, P2

with discharged air of different temperatures and humidities. The structure and function of the above mentioned device will be described in detail with the following embodiments.

FIG. 2 shows a basic structure of an electric circuit of an embodiment of this invention including the sensor unit 3 and the controller 20. The sensor unit 3 consists of one or several sensors 39 (only one sensor is shown in the figure) directed to respective sensing areas. The sensor 39 can be a prior art sensor, such as a pyroelectric-infrared sensor to sense the infrared radiation Pr of human body. The output signals from the sensor generate pulse signals through the amplification of an amplifier 391 and the check of a comparator 392, and then to an inverter 393 (it can be omitted) which provides signals to the controller 20. The controller 20 generates interrupt signals, and finally the air source 1 and the control device 2 start to execute the required work based on the programming of unlisted software program.

FIG. 3 shows the structure and function of a first embodiment of this invention. The air source 1 mainly includes a fan which, based on the control of the controller 20, generates an adequate quantity of air W. The control device 2 includes a number of flow-conduits 22 which direct discharged air to the ventilating areas A1, A2, A3, A4, A5, etc. respectively. Each flow-conduit 22 has a control valve 21 which, under the control of the controller 20, modulates the ventilating volume of air discharged through each flow-conduit 22. Each valve can fully open to provide a large quantity of airflow Wf, half open or open with any degree to provide a smaller quantity of airflow Wn, or each valve can be

totally closed. The sensor unit 3 has as many transmitters 311, 312, 313, 314, 315, etc. as the number of the flow-conduits 22, the transmitters may be of ultrasonic-wave, infrared rays, or a laser units. Each transmitter corresponds to each flow-conduit 22 of the ventilating areas A1, A2, A3, A4, A5, etc., and consequently, each transmitter can send encoded signals to one ventilating area. For example, when there is a person Pf in the area A2, the signals sent from the transmitter 312 are reflected by the person Pf, received by a receiver 32 and judged by the controller 20 which can detect the user Pf and the distance Df in the area A2; and, a strong intensity airflow Wf will be blown out consequently. A mild intensity airflow Wn will be sent out to a user Pn in the shorter distance Dn of the area A4. The control device 2 controls each flow-conduit 22 corresponding with the movement of the people. Therefore, it follows people wherever they move, and provides an economical ON/OFF and ventilation; and whenever no person is present in the ventilating areas, the control device 2 controls and turns off the air source 1. The controller 20 also has a user's interface which enables the user to input the required ventilation conditions such as speed, temperature, and humidity of discharged air, natural-wind simulation, airflow discharged directly toward the users or around the users, etc. The sensor unit 3 will follow the user and enable the control device 2 to provide adequate airflow based on the specific requirements. For example, when a unshown user in the area A1 uses a user's interface 29 through a wiring or wireless control to input the specified ventilation requirement, the air source 1 and the volume-control valve 21

corresponding to the area A1 will be adequately controlled by the controller 20, and consequently, the area A1 will get the needed ventilation. When the user moves from the area A1 to the area A2, the receiver 32 senses that the signal from reflection transmitter 311 disappears, and that the signal from transmitter 312 commences. As a result, the ventilation in the area A1 stops and that in the area A2 commences. If the user's requirement is not to ventilate directly but nearby, then to the user in the area A2, the control unit 2 controls the ventilation to have air flowing in area A1 and A3 or an upper zone beyond the user instead.

A natural-wind simulation can be achieved by controlling the air source 1 and the control valves 21 in a preset mode in which parameters are recorded and digitized from a natural wind environment. Therefore, the user can select the mode and enjoy a simulated natural wind.

FIG. 4 illustrates an embodiment of the invention where the air with different temperatures is discharged into different portions of the ventilation area, respectively, based on the controls of the air source 1 and the control device 2 of the above mentioned embodiment. FIG. 5 is a sectional view taken in the position 5-5 of FIG. 4. The air source 1 in the embodiment of FIGS. 4 and 5 includes a fan 11 where the generated air flows through a heat exchanger 42. Then the air, with a certain temperature and humidity, leaves the heat exchanger and then is led through the control of each flow-conduit 22 via the control valve 21. Each flow-conduit 22 has an air-mixing entrance 23 connected to another air source 14 which is of different temperature and humidity. Each

entrance 23 has an air-mixing control valve 231 actuated by the controller 20 which can be, for example, fully-closed 231c, a fully-open 231f, a half-open 231h or partially open to permit to induce adequate quantity of air 140. The air 140 is mixed with air from flow-conduit 22, thus, the humidity is changed, the temperature is modulated and the mixed air comprises the discharged or output air 15. For example, through the operation of the heat exchanger 42, the generated air 13 with temperature T1 and flow quantity Q1 mixes with the air 140 with temperature T2 and flow quantity Q2, and obtains a mixed air 15 at temperature (T1*Q1+T2*Q2)/(Q1+Q2) with flow quantity (Q1+Q2). Similarly, when the air 13 with absolute humidity H1 and flow quantity Q1 mixes with the air 140 with absolute humidity H2 and flow quantity Q2, a mixed air 15 with absolute humidity (H1*Q1+H2*Q2)/(Q1+Q2) will be obtained. Consequently, the temperature and humidity of each mixed or discharged air 15 can be modulated by each flow quantity Q1, Q2 where the air 13, 140 pass through each flow-conduit 22 under the control of each valve 21, 231.

FIG. 6 shows another embodiment of this invention where the airflow and discharging direction controlled by the control device 2 are exemplified. The flow output of the air source 1 is controlled by the flow-conduit 22 and the control valve 21. Each control valve 21 consists of two flaps 211, 212 pivoted on the conduit wall 221 which flaps can be swung synchronously to open/close the conduit 22 as indicated by arrow X in the figure. The conduit 22 can be a fully-open C1, fully-closed C2, a half-open C3 or partially open C4 to allow needed air to flow into the

conduit and be directed by the conduit wall 22 and a grille 222 which is fixed in the conduit to the specified direction.

FIG. 7 shows a further embodiment of the conduit 22 in FIG. 6. FIG. 8 is a sectional view in the position 8-8 of FIG. 7. This embodiment shows that in each conduit 22, in addition to the conduit wall 221 and the fixed grille 222 directing to a specified direction (usually it is a specified angle in the horizontal plane), there are several parallel movable-grilles 223 pivoted on the conduit wall 221 by the axles 224, which can direct air flowing in another axial direction (for example, the vertical direction) as indicated by arrow Y. Another function of the movable grilles 223 is when they are positioned in the closed state 223c, as shown in FIG. 8, dust and impurities can be prevented from entering the device when the machine is not in use.

FIG. 9 is the construction and function of another embodiment of this invention. In this embodiment, the same controller 20, the user's interface 29, the air source 1, the control device 2, and the sensing unit 3 are included as in the first embodiment indicated in FIG. 2. In this embodiment herein, the control device 2 consists of two sets of parallel movable-grilles 25 and 26 to regulate air flowing in two perpendicular directions (for example, horizontal and vertical directions). The sensing unit 3 senses a human's existence or presence within an angle A and such presence will signal the controller 20 to regulate the air source 1 and the control device 2 for adequate air supply as indicated in the drawing. When the sensing unit 3 senses users P1, P2 at the same location in angle A, the control device 2 discharges airflow Ws to one direction only. If

there is more than one person and the persons are in different locations, (for example, there is a user P3 in another location) the control device 2 will then swing the grilles 25 and 26 to direct airflow Wr into area "a" with varying direction. Furthermore, the grille 25 can also be at a closed-position 25c to avoid dust and impurities when the machine is not in use.

FIG. 10 is a modified embodiment of the control device 2 of the FIG. 9. This embodiment contains two (or more) sets of movable grilles 251, 261 and 252, 262, which can swing independently to cover different ventilating area B1 and B2. As a result, the whole service or ventilating area is expanded, each grille set does not swing with an extended range, and the overall efficiency is therefore improved.

The volume-control valves 21 (FIG. 3, FIG. 4), 211, 212 (FIG. 6), the mixed-air valve 231 (FIG. 5), and the movable grilles 223 (FIG. 7, 8), 25, 251, 252, 26, 261, 262 (FIG. 9, FIG. 10) in the above mentioned embodiment are actuated by unshown actuation devices (motors, solenoids, gears, screws, connecting rods, etc.) controlled by the controller 20. The controller 20, basically, is a microcomputer consisting of software program to execute the functions mentioned in the above embodiments; the sensor unit 3 and each actuation device also function based on it. These actuation devices and microcomputer can be easily obtained by the prior art and need not be described hereinafter.

FIGS. 11 and 12 show another embodiment of the sensing unit 3 and its function to distinguish the presence and position of a human body. The sensing unit 3 contains a sensor 33, such as an infrared sensor,

combined with a rotatable mirror 34 or multifaced mirror 35 to scan various zones in the area A. The zones can be in one or two dimensions. The sensor 33 can also be implemented as a rotatable scanner. For example, in the figure, a user P1 is sensed at angle θ1, and another user P2 at angle θ2. The controller 20 controls the rotation of the mirror 34 or 35 and also processes the signal sensed through the sensor 33. As FIG. 12 indicates, the controller 20 processes the detected signal Sd by comparing it with a reference signal Sr detected from a region with no human presence in range A. The reference signal may have included any fixed thermal source such as a machine, equipment, etc. The controller 20 will store the reference signals Sr into memory first and delete (neglect) the non-person thermal source signal during operation. Thus, the signals Sd at angle θ1 and θ2 will be compared with reference signals Sr to see if there is any obvious difference; if there is no obvious difference, the point θx of non-person will be ascertained as no person present in.

FIG. 13 is a diagram illustrating the outward appearance of another embodiment having a human sensor installed at horizontal-movable grilles. The ventilating device at this embodiment is an automatic atmosphere controller which modulates the interior atmosphere or is a part of a conventional air conditioner 100. The main machine is positioned between an interior space and an exterior space to provide different air controls including circulating the interior air, discharging the interior air to an exterior space or sucking the exterior air into an interior space. A two-way communication remote-control unit 290 is

used to transmit and receive signals between a user and the main machine. The main machine 100 has a display unit 290 to display the operating status of the main machine. A human sensor 39, can be a pyroelectric infrared sensor, is to detect/measure the presence of human body to execute the auto ON/OFF. At the left-side and right-side of the frame 10, there are inward vents 12 which have blades can be opened or closed. At the unshown rear of the frame 10 there are outward vent, which, accompanying with the operation of unshown fan positioned at the interior compartment of the main machine 100 and the open/close of the blades of the vent, can properly modulate the intake, discharge and circulation of air. Its structure and operation are not claimed and need not be described in detail at this invention.

The interior air (return air) 15A enters, through the upper gaps and side gaps of front panels of the main machine 100, the ventilating device. That air then, through filters and adequate temperature- and humidity-adjustment, discharges from outlet 250 as discharged air 25A. The outside portion of the outlet 250 equips with a closing device 255 which can be closed and opened to shut off the outlet while not in use. The outlet 250 further equips with a direction-adjustment device which can adjust the horizontal- and vertical-direction of discharged air 25A. The direction-adjustment device includes a set of vertical-movable grilles 26 which can control the vertical direction of discharged air (as in FIG. 14) and a set of horizontal-movable grilles which can control the horizontal direction of discharged air. A human sensor 30, can be a narrow-range pyroelectric infrared sensor, is integrally installed at the

horizontal-movable grilles 25. This human sensor 30 follows the swing of the horizontal-movable grilles 25 and detects the presence and position of the human body at each swing. The signals generated in response to the detection can be used to control the direction and duration of discharging air. Its operation will be further described in FIG. 14.

FIG. 14 is a diagram illustrating the function of sensor 30 of the embodiment of FIG. 13. A user input unit 295 is used to receive user's requirements including at least mode of discharging air, which contains one of at least air discharged directly toward person and "follow" the movement of human body or air discharged "around" a person. This requirement, after been received by a controller 20, can be used as a reference to modulate the operation and actuation of relative fan motor 11, the vertical-movable grilles 26 and horizontal-movable grilles 25. A human sensor 30 scans, while following the swing of horizontal-movable grilles 25, at a ventilating area A. At angle A1, it detects as shown in FIG. 14 that there's the presence of a person P1 and generates a corresponding signal. The controller 20, while receiving this signal, if the user's requirement of the discharging mode is discharging directly toward the person and follow the movement of human body, controls the horizontal-movable grilles 25 to stop the swing for a proper time at the angle A1, to provide a discharging airflow W1 directed to the physical position of the person P1 (while the vertical-movable grilles 26 is adjusted at a proper direction) for a proper duration. Then the swing continues. At angle A2, the human sensor 30 senses that there's a person P2 present, the controller 20 will stop the swing of the horizontal-

movable grilles 25 for a proper duration to have airflow W2 discharged directly toward the human body P2. The duration of the airflow can be a fixed value or be proportionally adjusted according to the number of persons present in the ventilating area, i.e., can reduce each stop of swing while there are many persons in the ventilating area. The operation of "follow" mode of air discharging will be further described in FIG. 15.

At this embodiment, the number of persons is calculated from signals sensed from a round-swing (a right-scan plus a left-scan), or an average of more scans. And the value of the number of persons in the ventilating area can also be used to determine the required quantity of outdoor fresh air to be brought indoors.

FIG. 15 is a diagram illustrating the ventilating function in regulating the discharging air toward a human body. In a scan starting from left to right, the discharged air following the direction of the movable grilles 25 is moving in a certain speed (S1). While the sensor 30 (FIG. 14) detects the presence of a person P1, the moving is stopped and the airflow W11 is discharged directly toward the person P1 for a duration (S2). Then the horizontal-moving continues (S3). Till detecting another person present, the moving stops again and the airflow is discharged directly toward the second person. Upon swing to the rightmost point, the sensor and grilles scans backward from right to left and continues all these operations.

FIGS. 14 and 16 describe the operation in an "around" mode of air discharging. The horizontal-movable grilles 25 (FIG. 14) can be controlled, while detecting a person P1 at the moving (S1), to direct the

discharged air from the direction that originally is directly toward a person to, through the operation of the vertical-movable grilles 26 (FIG. 14), a upper portion (S2) or a lower portion (S2') around the person P1 so that the person P1 will not have a direct airflow W12 (or W12') and yet acknowledge an airflow because of the convection. After a proper duration, the horizontal-movable grilles 25 continue the swing and also the human sensor 30 follows that moving (S3). While detecting in the absence of a person, the vertical-movable grilles 26 direct back to its normal position to have a horizontal airflow. The grilles 25 can be further controlled to stop for a duration (S4) to produce an airflow W14 around the person P1. Then, continues the moving and scanning (S5) till a further person is detected. While the moving reaches the rightmost point in the ventilating area the system then swing backward from rightmost to leftmost and so does the scan.

Certainly, the revolution of the fan motor 11 (FIG. 14) can be controlled and accompanied with the characteristic of the integrally swing of the human sensor and the horizontal-movable grilles to achieve the "follow" mode of air discharging. This can be accomplished through: while the human sensor 30 detects the presence of a person, the controller 20 will stop the swing of the horizontal-movable grilles 25 and also increase the revolution of the fan motor 11 to provide a larger volume of discharged air (or a periodically varying speed of airflow or a simulated natural wind). After a proper duration, the revolution of the fan motor 11 will be changed to an adequate value and continue the swing and scan till another person is detected.

In an "around" mode of discharging air, if the ventilating area does not equip with a set of grilles which direct the vertical direction, it can achieve the same effect through modulating the revolution speed of the fan motor 11. While the human sensor 30 detects, through following the swing of the horizontal-movable grilles 25, the presence of a human body, the controller 20 will modulate the revolution speed of the fan motor 11 to change its output volume of the airflow from an original normal value to an adequate value, that the person will not feel a direct air discharging, or simultaneously modulate the swing speed of the horizontal-movable grilles 25 to enhance the indirect air discharging.

While the invention has been described by references to the specific embodiments chosen for purposes of illustration, it should be apparent that numerous modifications could be made thereto by those skilled in the art without departing from the spirit and scope of the invention.

CLAIMS

1. A ventilation device, capable of adjusting and controlling itself automatically by detection of movement of a human body in a ventilating area comprising:

means for generating air to be discharged;

means for controlling the operation of said air generating means;

means for sensing the presence and location of said human body in said ventilating area and for generating signals in response to said presence and location;

input means for a user to input ventilation requirements of at least the direction of discharging air relative to the physical position of said user: and

said controlling means responsive to the signals from said sensing means and the user input for discharging air to said user only when said user is detected in said ventilating area.

2. A ventilation device, capable of adjusting and controlling itself automatically by detection of movement of a human body in a ventilating area comprising:

means for generating air to be discharged;

means for controlling the operation of said air generating means;

means for sensing the presence and location of said human body in said ventilating area and for generating signals in response to said presence and location;

input means for a user to input ventilation requirements of at least the direction of discharging air including one of directly toward and

indirectly toward the physical position of said user; and

said controlling means responsive to the signals from said sensing means and the user input for discharging air to said user only when said user is detected in said ventilating area.

3. A device as defined in claim 1, wherein said controlling means automatically turns off said air generating means in the absence of a human body in said ventilating area.

4. A device as defined in claim 3 wherein said controlling means controls one or more of the temperature, humidity, speed, mode and direction of said discharged air.

5. A device as defined in claim 1, wherein said ventilation device includes at least one outlet and said controlling means closes said outlet in the absence of person detected in said ventilating area to avoid dust or impurities from entering said device.

6. A device as defined in claim 1, wherein said controlling means includes at least one flow-conduit for directing the path of discharged air therethrough.

7. A device as defined in claim 6, wherein each flow-conduit includes a control valve controlled by said controlling means in a natural wind mode where control parameters are prerecorded from a natural wind environment.

8. A device as defined in claim 6, wherein each flow-conduit contains grilles to further modify said path of discharged air in two axes.

9. A device as defined in claim 6, wherein each flow-conduit contains a mixed-air entrance connecting to another source of air having

a different temperature and humidity;

each said mixed-air entrance including a mixed-air valve operable for combining air of different temperatures and for regulating the output of temperature and humidity of mixed-air from each flow-conduit.

10. A device as defined in clam 1, wherein said controlling means includes at least a set of movable grilles which can be independently moved to provide a discharged air path which covers at least a part of said ventilating area based on said location of a human body sensed by said sensing means.

11. A device as defined in claim 1, wherein said sensing means includes at least two remote-measuring units to sense said location of said human body in different parts of said ventilating area.

12. A device as defined in claim 1, wherein said sensing means includes remote-measuring units which respectively scan said ventilating area with a scanning signal;

said sensing means receiving a reference signal in the absence of a human body in said ventilating area and receiving signals reflected from a human body, for comparing with said reference signal said location of a human body being based on the difference of said comparison of said reference signal and said reflected signal.

13. A device as defined in claim 1, wherein said controlling means includes at least one flow-conduit for adjusting the volume of discharged air flowing therethrough.

14. A device as defined in claim 13, wherein said controlling means includes a control valve for adjusting the volume and direction of

discharged air flowing therethrough.

15. A ventilation device. capable of adjusting and controlling itself automatically by detection of movement of a human body within an area to be ventilated comprising:

means for discharging air into the area to be ventilated:

means for controlling the operation of said air discharging means includes at least a first set of movable grilles which can be independently moved to regulate the direction of the discharged air:

means for sensing the presence and location of said human body in said area and for generating signals in response to said presence and location:

input means for a user to input ventilation requirements of at least the direction of discharged air relative to the physical position of said user:

said sensing means positions at said first movable grilles and scans integrally along with the movable grilles and generates signals in response of said scan: and

said controlling means responsive to the signals from said sensing means and the user input for discharging air to said user only when said user is detected in said ventilating area.

16. A device as defined in claim 15, wherein said controlling means having prestored program for controlling the duration of scan of said first movable grilles to adjust the duration of air discharged toward person in response to the signals from said sensing means in the presence of human body.

17. A device as defined in claim 15. wherein said air discharging means includes means for controlling the volume of discharged air flowing directly toward person in response to the signals from sensing means in the presence of human body.

18. A device as defined in claim 15. wherein said controlling means further includes a second set of movable grilles which can be moved to regulate the direction of the discharged air flowing nearby and avoiding direct toward the physical position of human body in response to the signals from said sensing means in the presence of human body and to the user requirement.

19. A device as defined in claim 18. wherein said controlling means includes means for controlling the volume of discharged air flowing indirectly toward the physical position of human body in response to the signals from said sensing means in the presence of human body and to the user requirement.

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Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

GB 9220562.4

Relevant Technical fields

(i) UK Cl (Edition K) G3N (NGCA,NGE1,NGE3AC,NGE3A, NG1A4,NG1A9)
F4V (VCB)

(ii) Int Cl (Edition 5) F24F

Search Examiner

M J DAVIS

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

21 OCTOBER 1992

Documents considered relevant following a search in respect of claims 1-19

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
	NONE	

Category	Identity of document and relevant passages	Relevant to claim(s)

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